

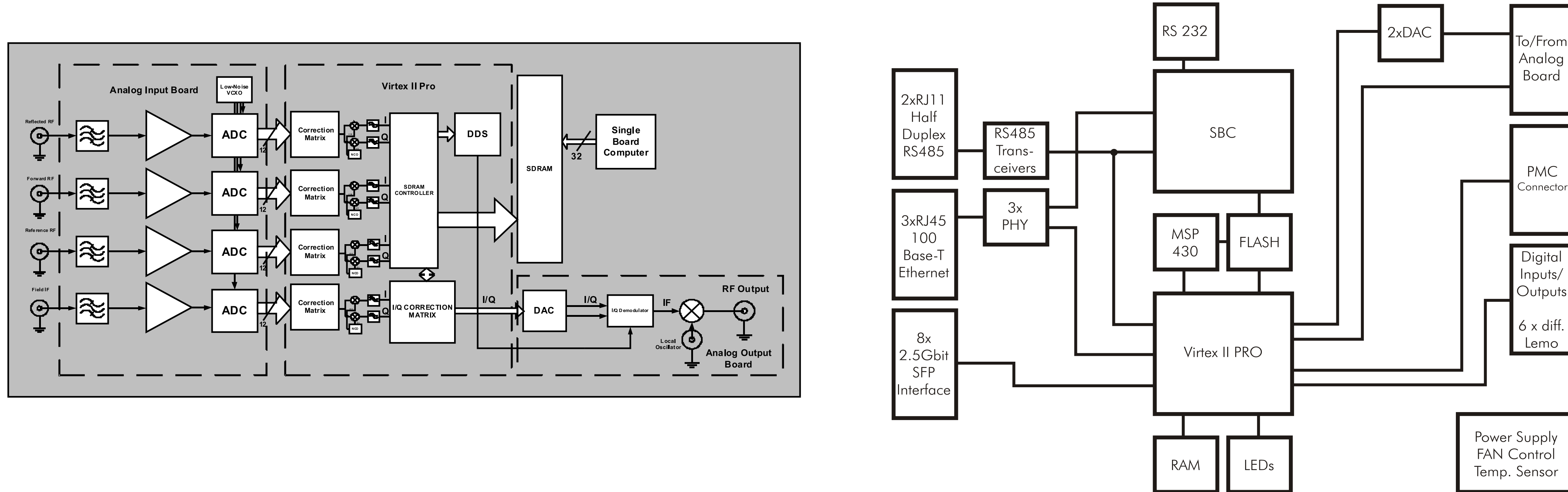
# Evaluation of Libera as Field Control Module

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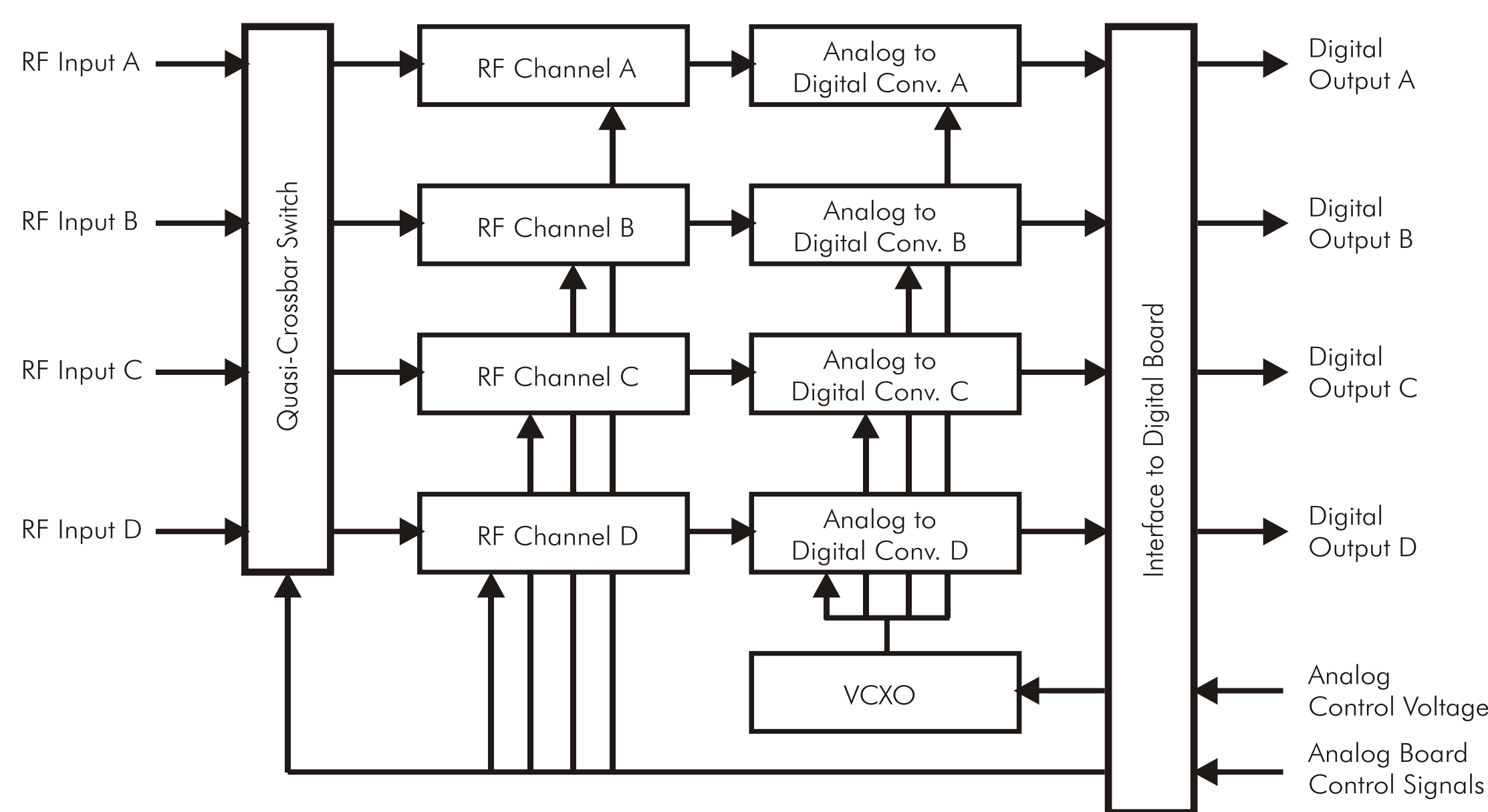
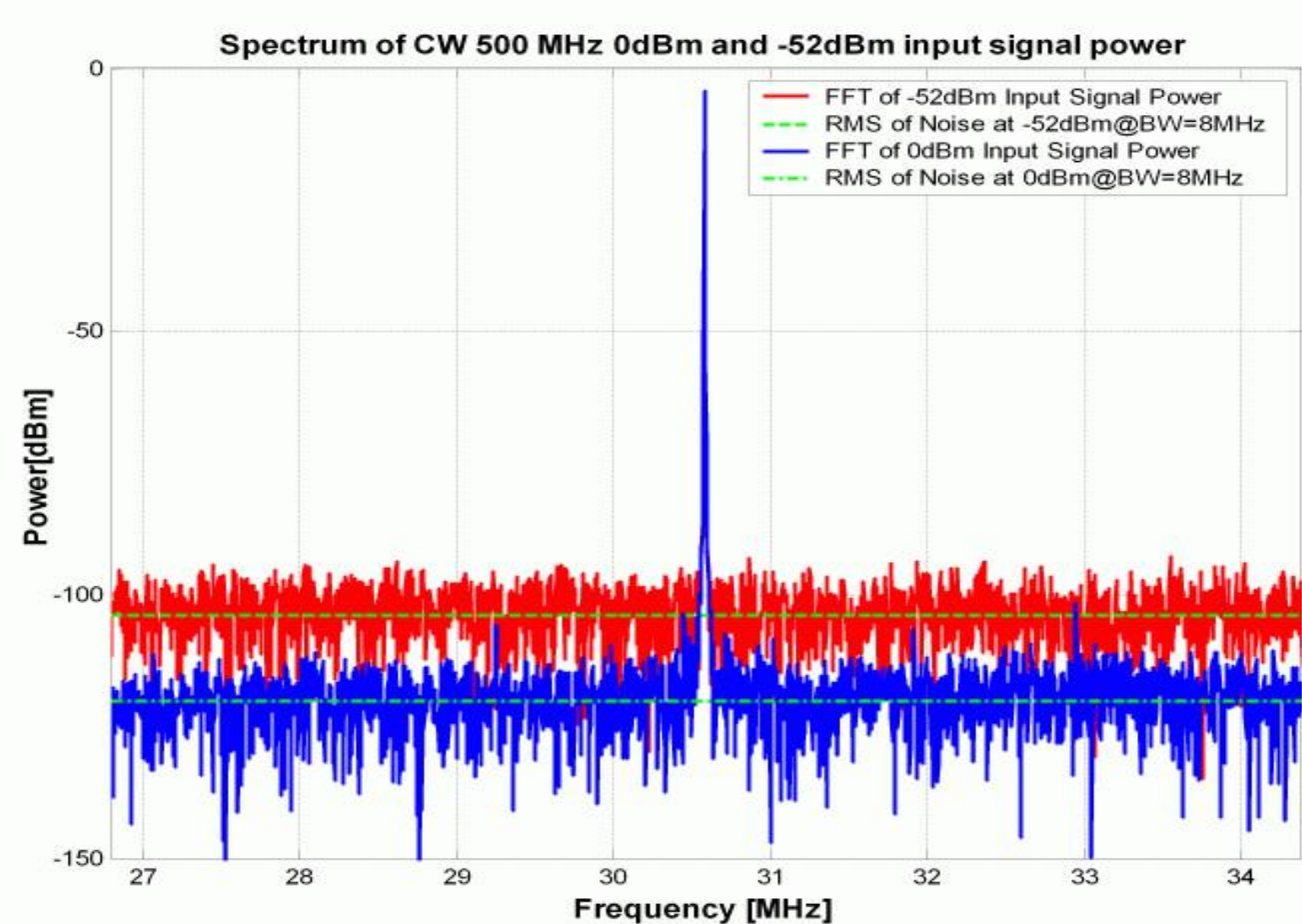
Libera is a product family targeting instrumentation and controls applications on particle accelerators. So far two members have been introduced and very well accepted by the accelerator community. Libera's hardware architecture presents a universal platform that has all the hardware interfaces to convert signals from analog to digital and vice versa. In between there is a big FPGA that offers abundant computing power for loop control. This poster presents a possible application of Libera as a field control module in a LLRF control system.

## Functional Block Diagram of Libera for Field Control Applications



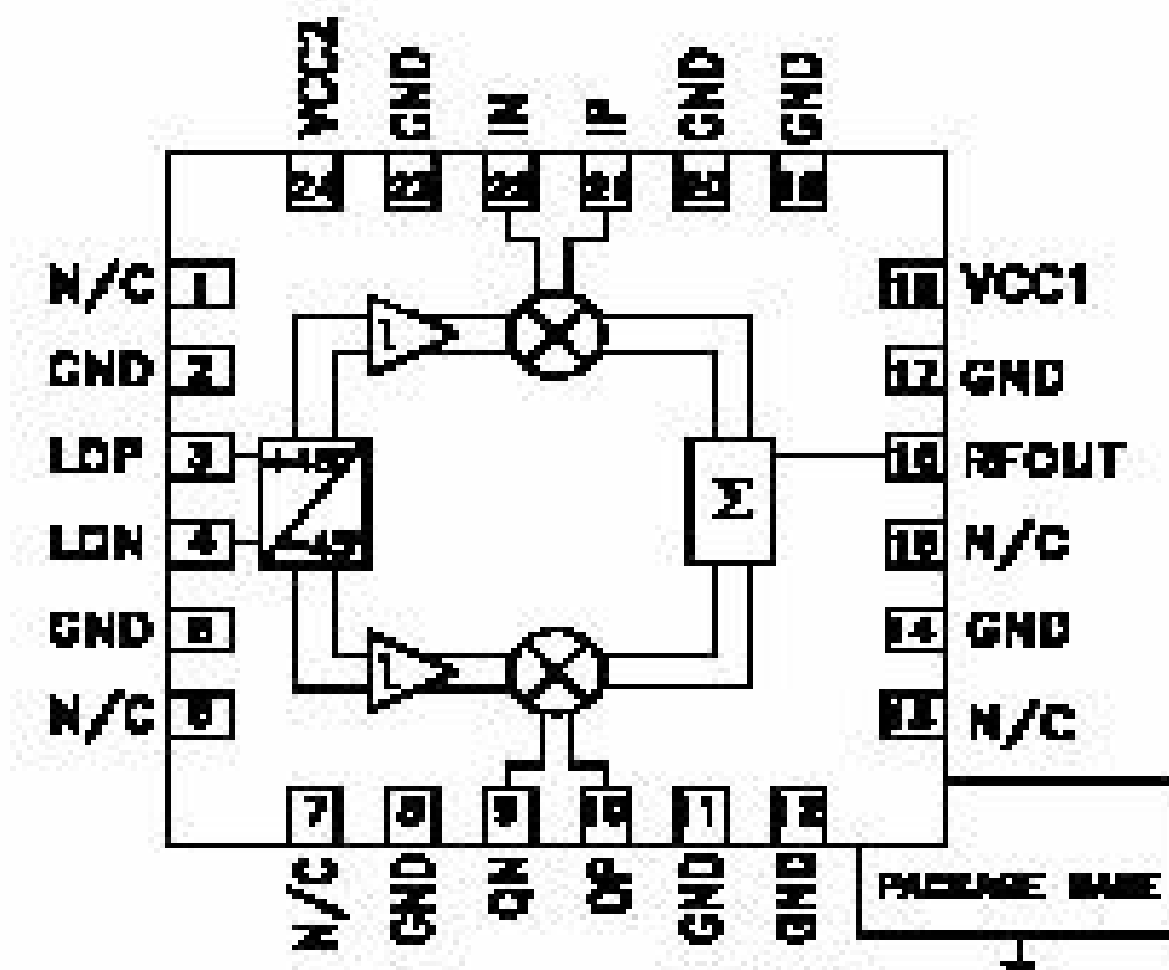
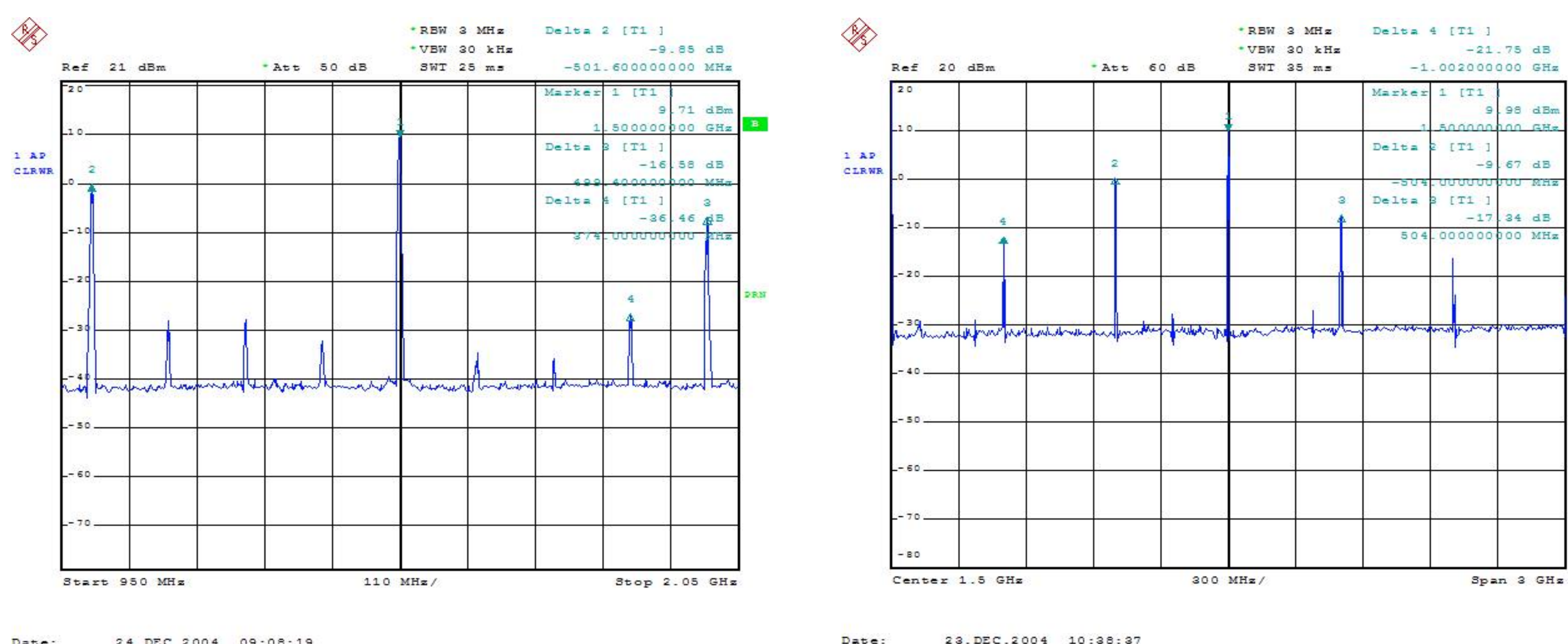
Open architecture of the digital board allows us to use Libera's motherboard as a platform for field control applications. The gray diagram shows a typical field control module implemented by using Libera's hardware.

## Input Analog Board Noise Measurements



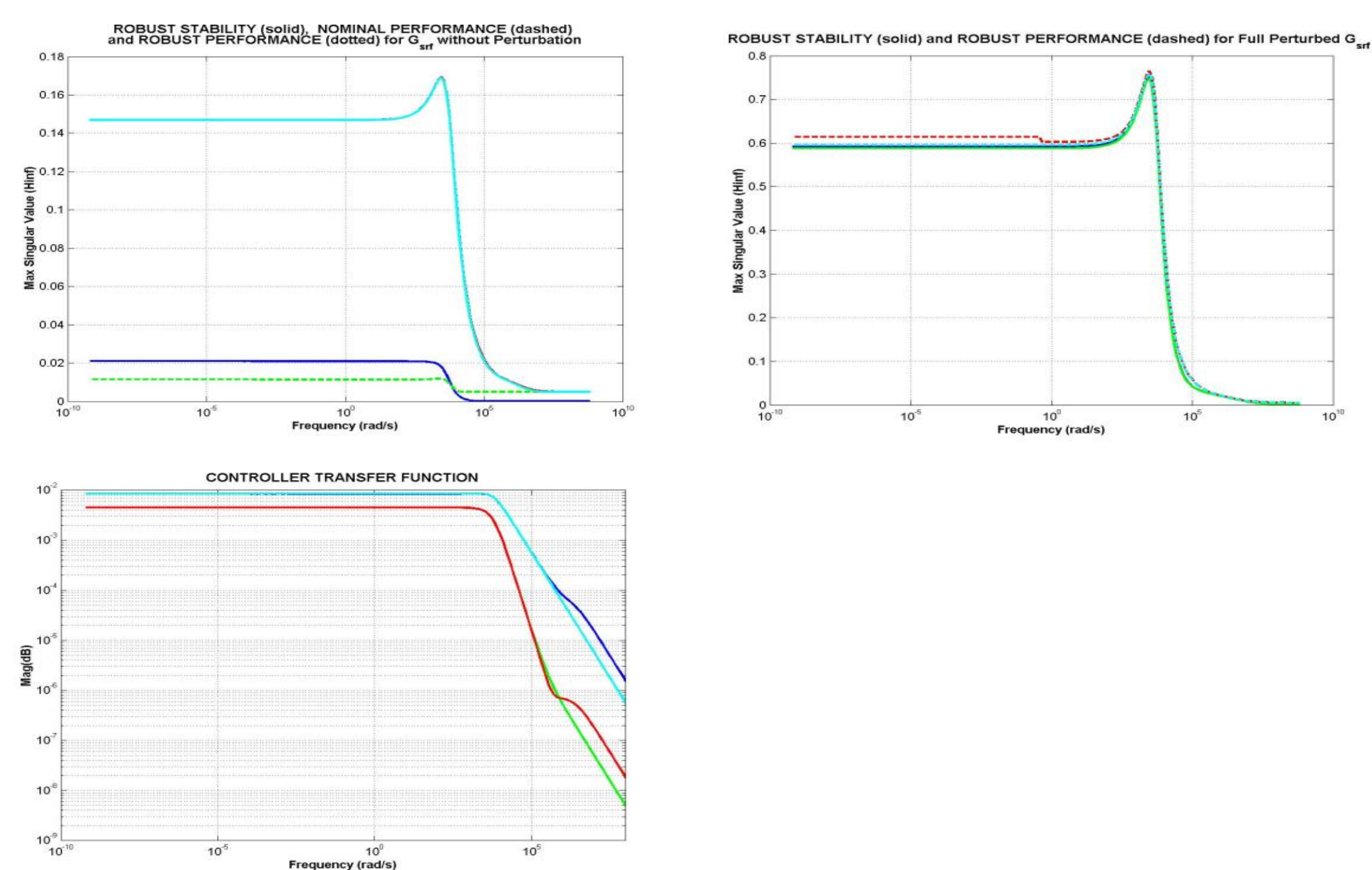
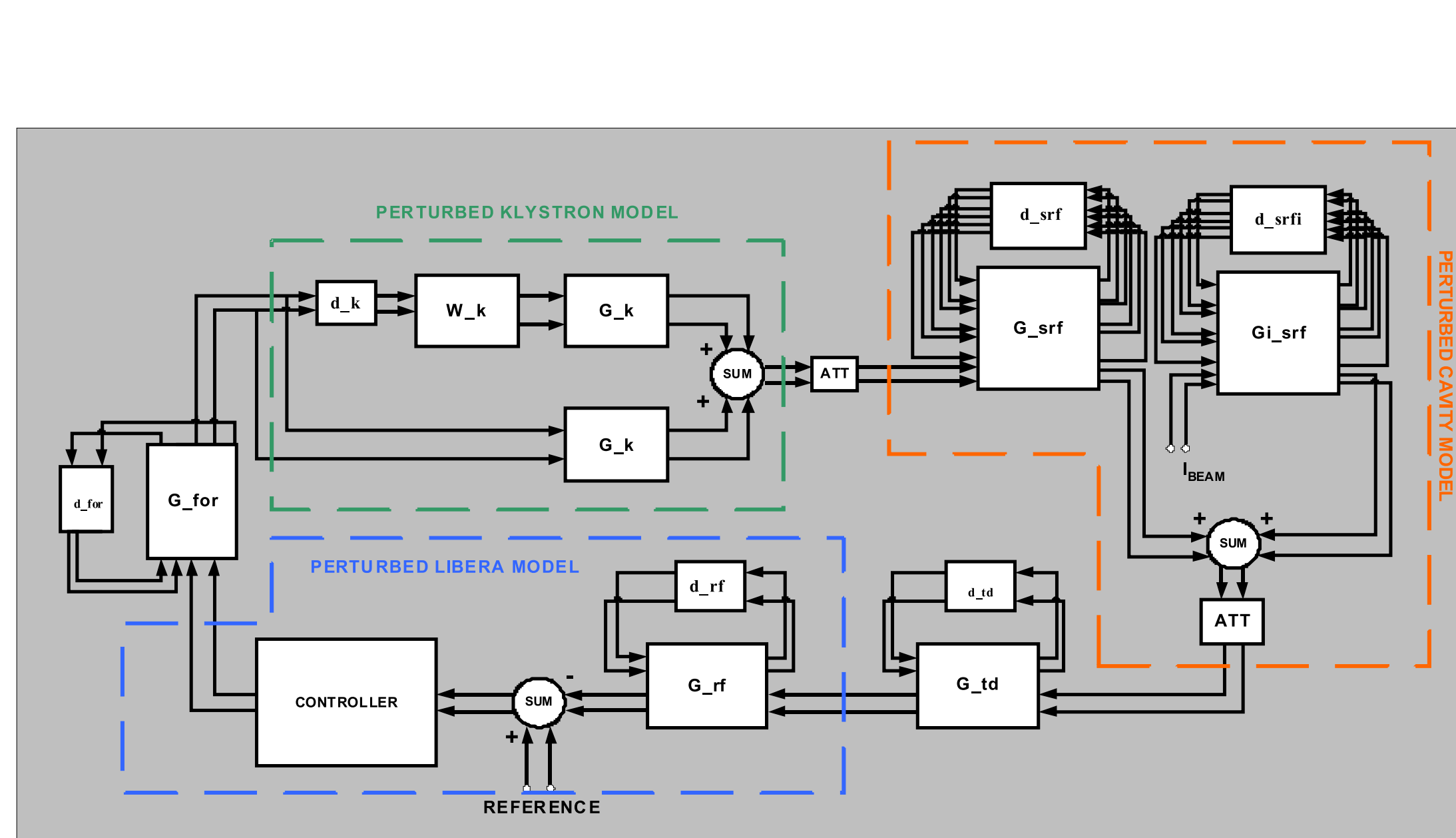
The input analog board consists of four parallel chains, which filter and amplify high frequency signals. At the output of the analog board fast sampling ADCs feed by a low jitter VCO do the analog to digital conversion. The FFT plot shows that good SNR ( $>90\text{dB}$  @  $\text{BW} = 1\text{kHz}$ ) in digital domain is expected.

## Output Analog Board Spectrum Measurements



At the output additional hardware besides Libera has to be used. A functional block diagram below shows a broadband quadrature I/Q modulator HMC497LP4 from Hittite. Wide span and narrow span measurements show good performances of I/Q modulator.

## Simulations Diagram and Some Results Using $\mu$ -analysis and H Synthesis



With MATLAB and  $\mu$ -analysis toolbox robust stability and robust performance of a simple closed loop control system were studied. Block diagram shows interconnections between specific system matrices representing a klystron, a superconducting RF cavity, cable time delay and Libera as a RF front-end and controller.

References:  
 [1] Kwon S., Regan A.: Control System Analysis for the Perturbed Linear Accelerator RF System  
 [2] Regan A., Thomson D.: System description of the RF control system for SNS. Draft of the final document